Observing Unobserved Fishing Characteristics in the Drift Gillnet Fishery for Swordfish

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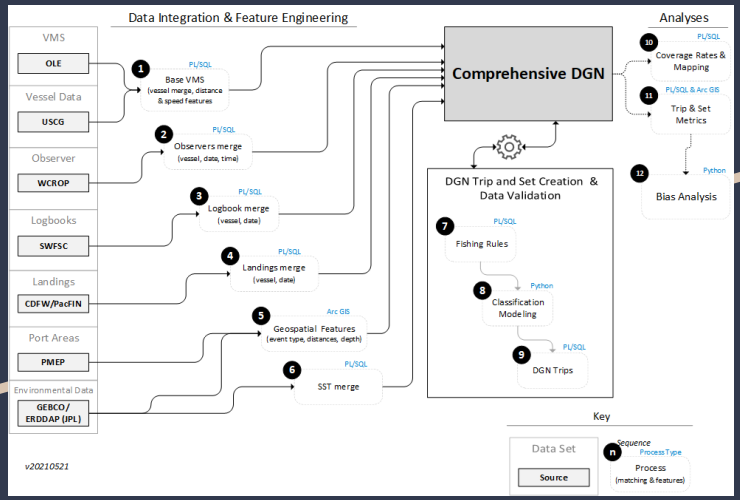
June 2021

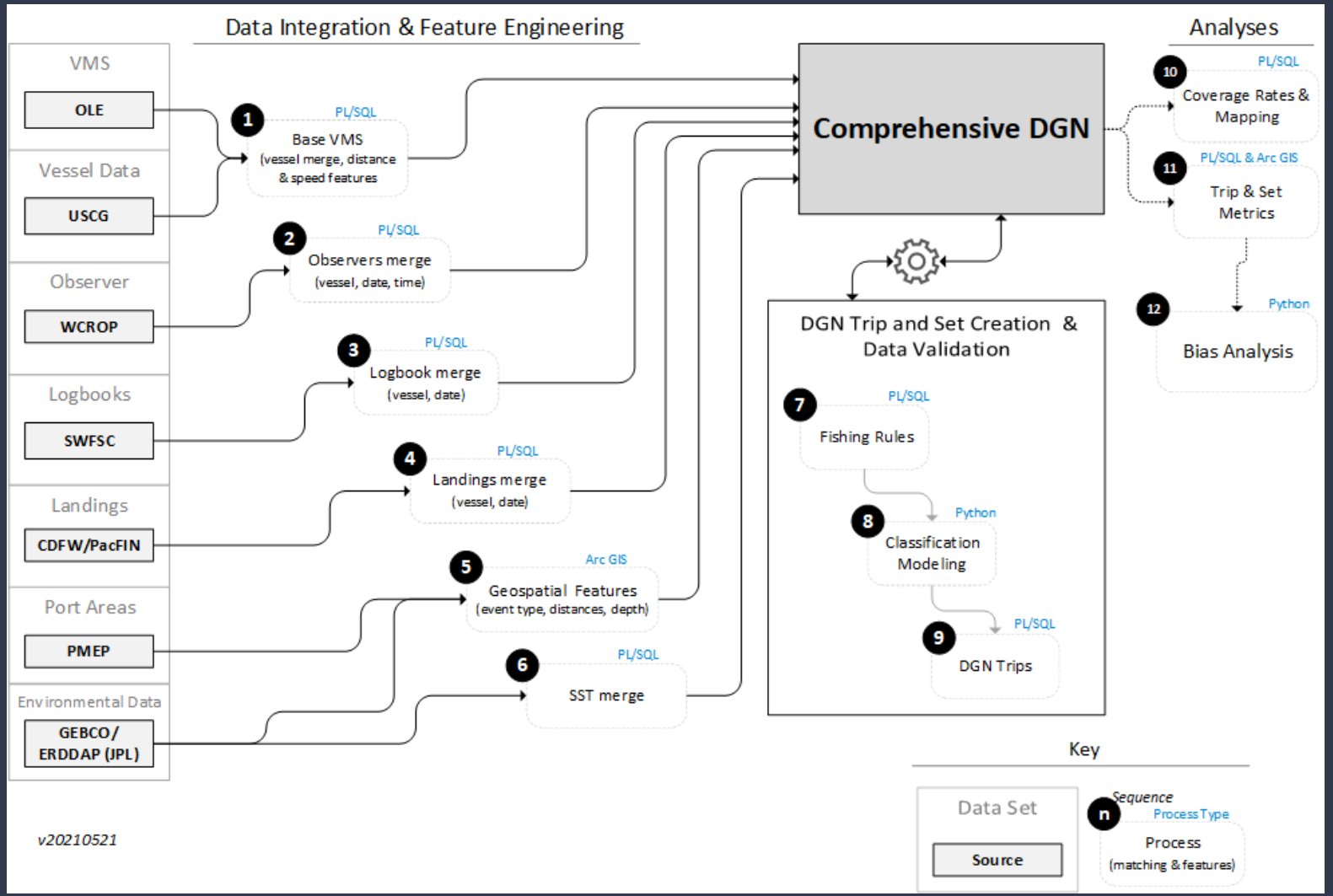
Presentation Outline

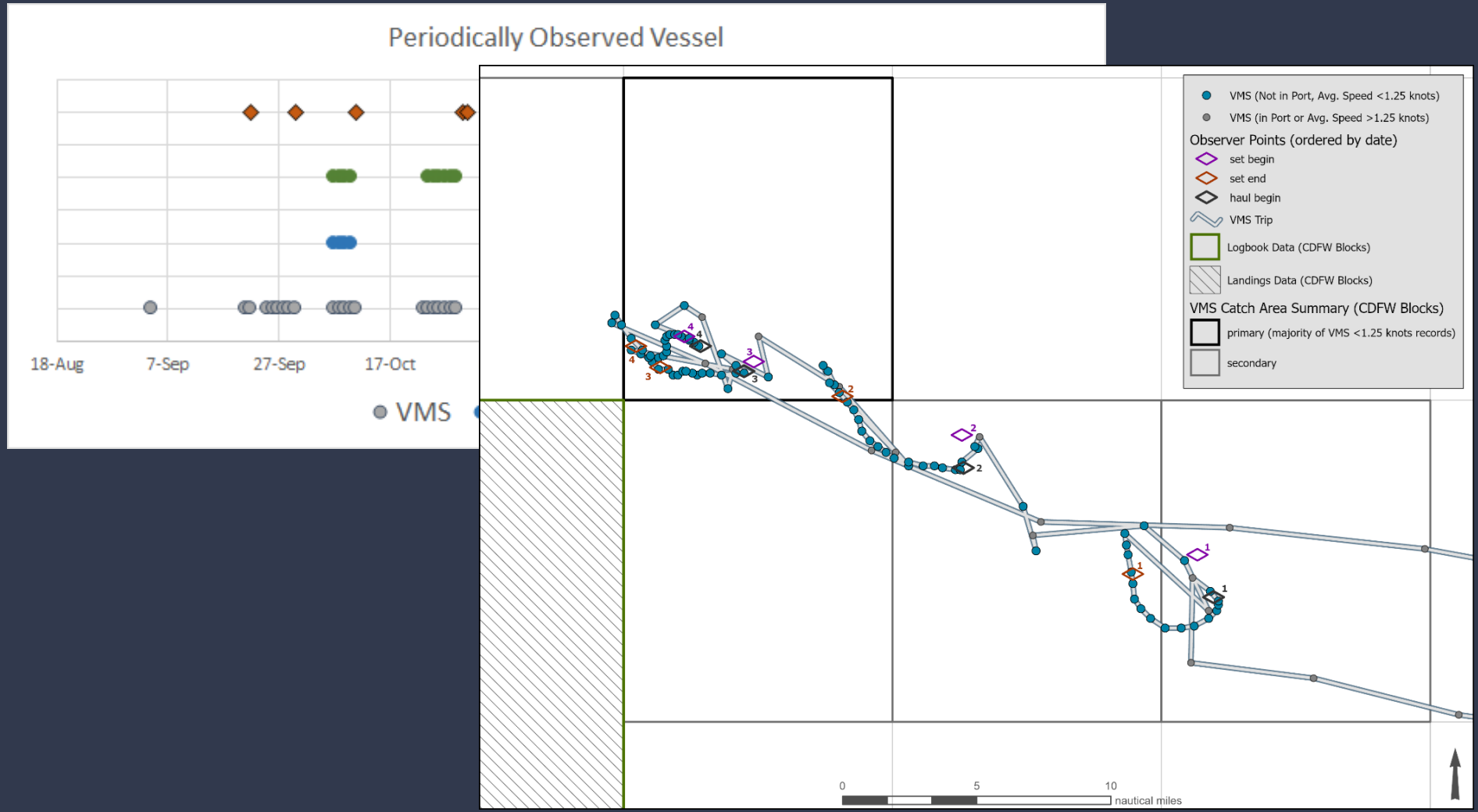
- ❏ Methods Part 1: Data integration
- ❏ Methods Part 2: Trip & set creation and validation
- ❏ Analyses & Results
  - ❏ Observer coverage
  - ❏ Vessel metrics
  - ❏ Bias analysis
- ❏ Conclusions
- ❏ Next Steps
- ❏ Questions?

Methods Part 1: Data Integration and Engineering Features (Steps 1- 6)

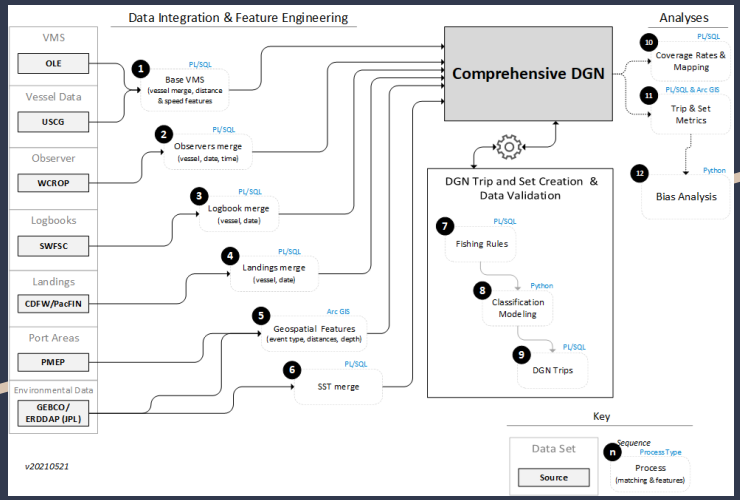


- ❑ Sept 2013 - Jan 2020 (6 seasons)
- ❑ 22 vessels
- ❑ Vessel Monitoring System (VMS)
- ❑ Vessel Characteristics
- ❑ Observer
- ❑ Logbook
- ❑ Landings
- ❑ Engineered geospatial features
- ❑ Environmental data (SST, depth)


Data Integration & Feature Engineering
VMS
OLE
Vessel Data
USCG
Observer
WCROP
Logbooks
SWFSC
Landings
CDFW/PacFIN
Port Areas
PMEP
Environmental Data
GEBCO/ ERDDAP (JPL)
1 PL/SQL Base VMS (vessel merge, distance & speed features
2 PL/SQL Observers merge (vessel, date, time)
3 PL/SQL Logbook merge (vessel, date)
4 PL/SQL Landings merge (vessel, date)
5 Arc GIS Geospatial Features (event type, distances, depth)
6 PL/SQL SST merge
Comprehensive DGN
DGN Trip and Set Creation & Data Validation
7 PL/SQL Fishing Rules
8 Python Classification Modeling
9 PL/SQL DGN Trips
Analyses
10 PL/SQL Coverage Rates & Mapping
11 PL/SQL & Arc GIS Trip & Set Metrics
12 Python Bias Analysis
Key
Data Set
Source
n Sequence
Process Type
Process
(matching & features)
v20210521


Periodically Observed Vessel
18-Aug
7-Sep
27-Sep
17-Oct
VMS
VMS (Not in Port, Avg. Speed <1.25 knots)
VMS (in Port or Avg. Speed >1.25 knots)
Observer Points (ordered by date)
set begin
set end
haul begin
VMS Trip
Logbook Data (CDFW Blocks)
Landings Data (CDFW Blocks)
VMS Catch Area Summary (CDFW Blocks)
primary (majority of VMS <1.25 knots records)
secondary
0
5
10
nautical miles

Methods Part 2: Trip and set creation & validation (Steps 7- 9)

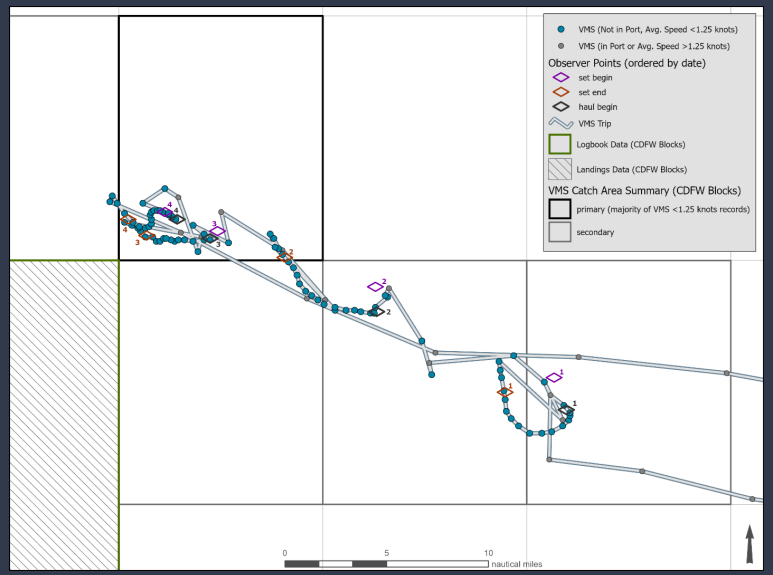


- ❑ Fishing rules
- ❑ Classification modeling
- ❑ DGN trips

Step 7: Fishing Rules for Trips & Sets

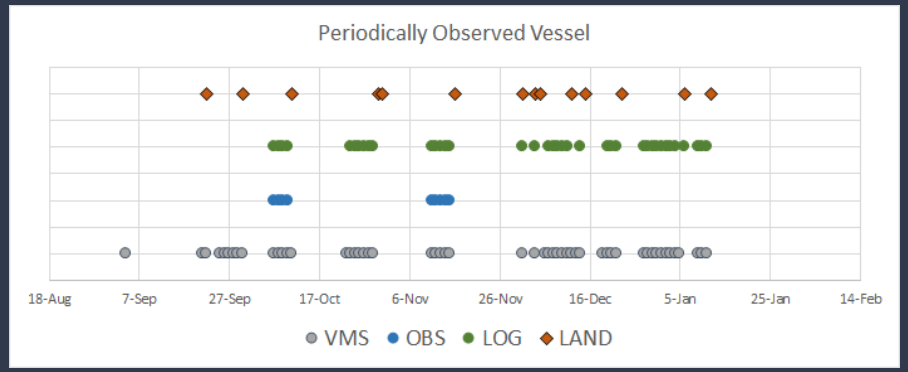
- ❏ Trips
  - ❏ ‘Depart Port’ to ‘Arrive Port’
  - ❏ >12 hours
- ❏ Sets
  - ❏ 3:00 PM to 8:00 AM
  - ❏ Speed < 1.25 knots
  - ❏ 10-12 hours (consecutive pings)
- ❏ Positive DGN fishing
  - ❏ Logbook and/or
  - ❏ Observer and or/
  - ❏ Landings
- ❏ Seasons
  - ❏ May 1 - Nov 15 (PLCA closure)
  - ❏ Nov 16 - Jan 31

Step 8: Creating DGN Sets Using Classification Models (Python)



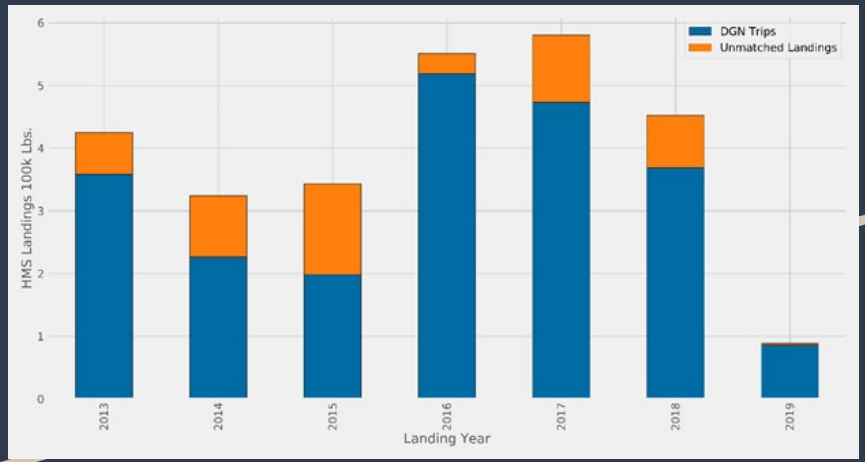
- ❑ Records used
  - ❑ Positive DGN Fishing
  - ❑ Event_type = ‘at sea’
  - ❑ Is_observed_ping
- ❑ 5 distinct models
- ❑ Trained on 75% of data
- ❑ Combination of Fishing Rules & Model Results & Soak Time
- ❑ Manual review & validation
- ❑ Positive Fishing Effort

Step 9: DGN Trips & Sets Validation



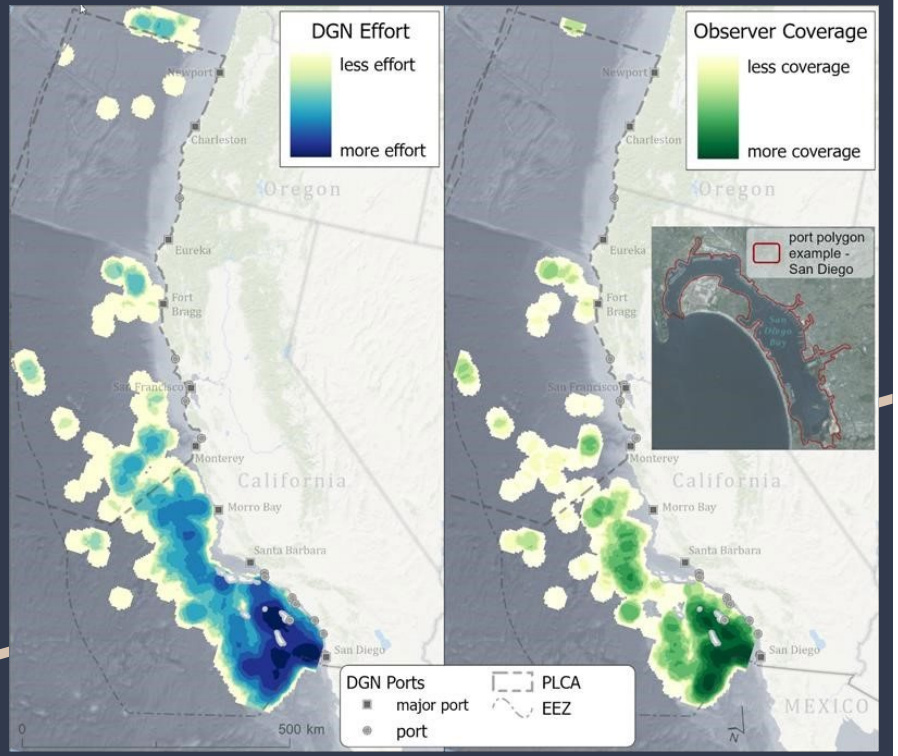
- ❑ Trip - DGN fishing (log/obs/land)
- ❑ DGN landing date ('in port'/'arrive port', species or HMS fishery code = DGNLM)
- ❑ Trips flagged for review
  - ❑ Log/obs, but no landing <= 5 days after 'arrive port'
  - ❑ Landings while 'at sea'
  - ❑ Landings w/o DGNLM code
- ❑ Sets flagged for review
  - ❑ < 6 pings in 12 hours
- ❑ Sequential Trip & Set numbers
- ❑ Power of data integration

Step 9: DGN Trips & Sets Validation



- ❏ Estimated 571 total DGN trips (trip link)
- ❏ Trip link 81% of the total estimated landings (lbs) across years, from a low of 58% in 2015 to a high of 94% in 2016
- ❏ 19% of the landings (lbs) were not linked to trips due to data gaps
  - ❏ Implementation of the rules
  - ❏ Transmission rate irregularities
- ❏ Estimated 2,448 total DGN sets (observer data and model predictions)

Step 10: Observer Coverage



- ❏ Compared estimated fishing (model) to observed fishing
  - ❏ Temporal
    - ❏ All years (left)
    - ❏ Weeks
    - ❏ Seasons
  - ❏ Vessel categories
    - ❏ Periodically Observed
    - ❏ Unobservable
    - ❏ Excluded

Step 10: Observer Coverage

Vessel Group	Number of Vessels	Unobserved Trips	Observed Trips	Percent Observed Trips	Unobserved Sets	Observed Sets	Percent Observed Sets
Excluded	**5**	**47**	**4**	**9%**	**156**	**17**	**11%**
Unobservable	**6**	**145**	**3**	**2%**	**528**	**11**	**2%**
Observable	**11**	**296**	**121**	**41%**	**1200**	**558**	**47%**
Totals	**22**	**443**	**128**	**22%**	**1956**	**586**	**23%**

- ❏ WCROP seeks to provide observer coverage on 20 – 30% of all sets in a given fishing year
- ❏ 40% of the fleet was made up of unobservable vessels (9 vessels = 6 unobservable + 3 excluded)
- ❏ 47% of sets made by periodically observed portion of the fleet was necessary to achieve 20 – 30% coverage rate

Step 11: Bias Analysis (Python)

Periodically Observed Vessels
Observed vs unobserved

Unobserved vessels
vs
Periodically Observed Vessels

- ❏ Linear mixed-effect model: quantify the percent difference between trip & set level metics by vessel group & season
- ❏ Vessel level metrics by vessel group
- ❏ Data Validation: plotted the distributions of the trip and set level metrics
- ❏ 364 trips (64%) and 1784 sets (73%)
- ❏ 2013/2014 fishing season not included in the observer bias analysis since the emergency rule (78 FR 54548) required all sets made deeper than 1100 fathoms to be observed

Step 11: Bias Analysis - Vessel Characteristics

Vessel Group	Number of Vessels	Capacity (net tons)		Engine (hp)		Length (ft)	
		Median	Range	Median	Range	Median	Range
Excluded	5	14	8-16	300	120-471	38	35-40
Unobservable	6	23	5-30	213	165-335	48	42-51
Observable	11	27	5-65	250	180-1000	51	27-65
All	22	16	5-65	244	120-1000	45	27-65

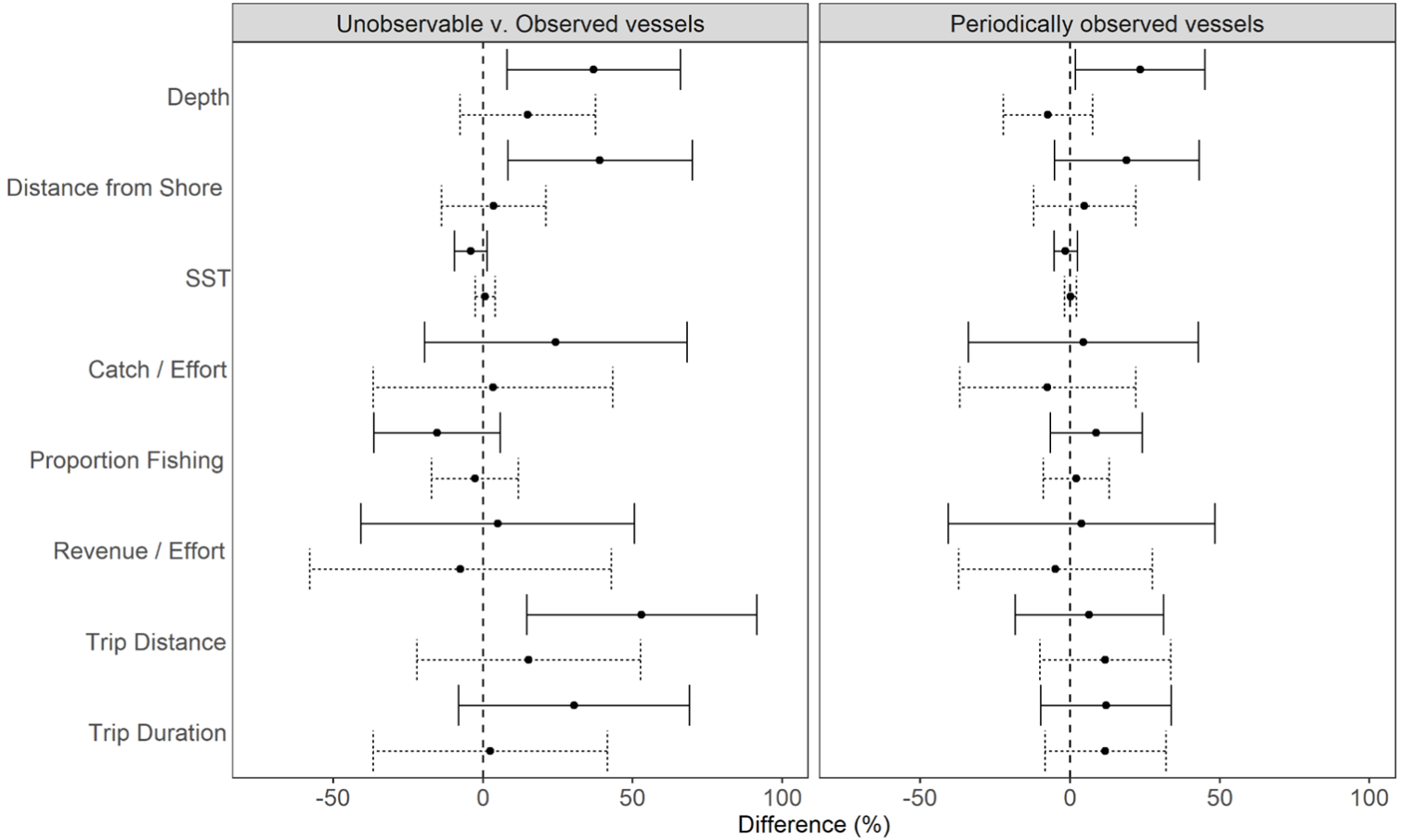
- The vessel metrics was variable for all groups, but the *observable* group contained smallest and largest capacities and engine horsepower
- The *unobservable* vessel group was slightly smaller in median length (48 ft) than the *periodically observed* vessels (51 ft)
- The median engine horsepower and net tonnage were 16% and 18% greater, respectively, for *periodically observed* vessels compared to *unobservable*

Step 11: Bias Analysis

- ❑ Trip & Set Metrics
- ❑ Vessel Groups
- ❑ Seasons

- ❑ Metrics for Trips & Sets
  - ❑ Avg Depth
  - ❑ Avg Distance from Shore
  - ❑ Avg SST
  - ❑ Catch / Effort (CPUE)
  - ❑ Proportion Fishing
  - ❑ Revenue / Effort
  - ❑ Trip Distance
  - ❑ Trip Duration
- ❑ Vessel Groups
  - ❑ Observed vs unobserved on *Periodically Observed Vessels*
  - ❑ *Unobserved* vessels vs *Periodically Observed Vessels*
- ❑ Seasons
  - ❑ May 15 - Nov 15
  - ❑ Nov 16 - Jan 31

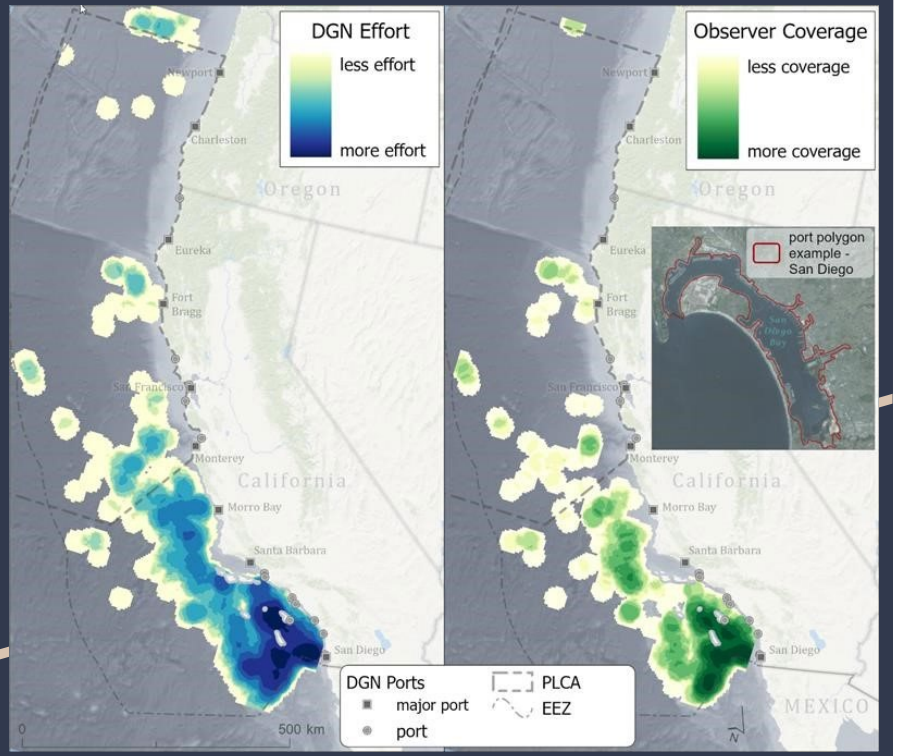
Step 11: Bias Analysis for Trip-level Metrics



Conclusions & Next Steps

- ❏ Holistic view of a fishery by integrating all of the data sets
- ❏ Engineered features for fishery rules, depth, temperature
- ❏ No overall bias
  - ❏ Few statistical differences in trip & set metrics between vessel groups
  - ❏ Some disparities in observer coverage
- ❏ Next Steps
  - ❏ Future data integration projects
  - ❏ Publishing this research

Questions?


DGN Effort
less effort
more effort
Observer Coverage
less coverage
more coverage
port polygon example - San Diego
Oregon
California
Newport
Charleston
Eureka
Fort Bragg
San Francisco
Monterey
Morro Bay
Santa Barbara
San Diego
MEXICO
DGN Ports
major port
port
PLCA
EEZ
0
500 km
N